oval or broadly oblong (about 4 lines long and fully two inches wide), plane, surmounted by a slender style of fully 2 lines in length; seeds only 3 to 6, orbicular, distinctly winged; embryo as in the preceding; petals pure golden yellow.—Cedar barrens, Lavergne, near Nashville, Tennessee, *Dr. Gattinger*, June 2, 1879.

Fresh specimens and notes are solicited by ASA GRAY.

AUTOMATIC MOVEMENT OF THE FROND OF ASPLENIUM TRICHOMANES.—Mr. E. J. Loomis, of the Nautical Almanac office, Washington, recently showed me a phenomenon which I suppose has never before been noticed, and which is commended to the attention of botanists. A tuft of *Asplenium Trichomanes*, gathered last autumn in the mountains of Virginia, is growing in his house, in a glass dish. About two months ago he noticed that one of the fronds—a rather short and erect one which is now showing fructification—made quick movements alternately back and forth, in the plane of the frond, through from 20 to 40 degrees, whenever the vessel was brought from its shaded situation into sunlight or bright daylight. The movement was more extensive and rapid when the frond was younger. When I saw it on the 23d of January, its compass was within 15 degrees, and was about as rapid as that of leaflets of *Desmodium gyrans*. It was more rapid than the second hand of a watch, but with occasional stops in the course of each half vibration. This was in full daylight next a window, but not in sunshine. No movement had been observed in the other fronds, which were all sterile and reclining, with the exception of a single one which was just unfolding, in which Mr. Loomis thinks he has detected incipient motion of the same kind.

It is very easy to obtain this little fern and to set it growing. We may expect further observations to be made upon it without delay.—ASA GRAY.

HOW TO MAKE PERMANENT BOTANICAL OBJECTS FOR THE MICROSCOPE.—In the GAZETTE for September, 1879, I had a short paper on staining and double staining of vegetable tissues. I desire now to add a few hints on the previous and the subsequent stages of the preparation.

Mounted objects may be divided into two classes, i. e., the opaque, and the transparent;—the former to be seen by a light (more or less strong) from above, and the latter by light passing through the object from below.

The first thing for the preparer to decide upon, is, which of these two classes shall any object come under?

If the former, the preparation is extremely simple. The whole problem resolves itself into making a suitable case for the treasure. To give a tangible idea suppose we have the seed of a Portulaca or the scarlet tip of a Cladonia, or the yellow apothecium of a Thelochistes. The first thing to do, is to see that your cage (or to speak strictly, your cell) is opaque and of sufficient depth to hold the object. Opticians now keep wooden slides with a central concavity ready to close by placing over it a glass cover. These are cheap and neat.

Or you may take the ordinary glass slide and fasten on to it by marine glue, the rubber, glass, block tin or other cell of any desired depth. Any ordinary work on the microscope will give instruction on the use of this or similar cement. Supposing now that the cell is made and fastened to the glass, I then paint a thick coat of the asphaltum cement over the whole bottom (inside) of the cell so made. This gives you an opaque field. When the object has been properly prepared, by cleansing, I put another coat of the asphaltum on over the first, and on this I place the object. There it becomes cemented as the varnish hardens and nothing is left save to put on a cover of the same or nearly the same diameter as the cell, and then lay on over the outer margin a ring of asphaltum, zinc or any suitable cement, which excludes the air and fastens the cover. This is all sufficiently simple. And it may be well to add that opaque objects are too much neglected because they are not to be used with other than a low power. The smaller lichens may thus be mounted bodily, and so far as their mere external characteristics go, studied more satisfactorily than by any other method. Besides we may then have them safe, handy, and in permanent keeping. Type specimens, if small, should as a rule be so preserved.

The second class:—objects through which the light is seen, i. e., transparent objects. Some are so thin as to need no sectioning and may, or may not, require the bleaching process described in my previous paper. Suppose they are not so thin! How are they to be made so? Evidently by a sharp knife of some form There are costly instruments of this kind made. Allow me to assure you, the assertion of dealers to the contrary notwithstanding, that you do not need any such knife for any ordinary work. A razor sharp enough to shave with is the best and handiest instrument you can use. Neither do you need to have the hollow ground out of one surface providing you hold it as you should hold things, i. e., with a firm hand. So then you may well be satisfied with a good razor; providing always that it be sharp. Next! How shall the object be held whilst being sectioned? First:—it may be held in the hand and if the cutting hand be reasonably steady a good section may be secured. Second:—it may be held in an instrument where it is simply screwed fast, and after the first cut gives you a flat surface, by a turn of a screw in the bottom the object thrust forward so that the next cut shall be of any desired thickness. This is my favorite means of holding the object, and if I have one so small that I cannot so secure it, I take a bit of carrot of the proper size, make a slit in this, in which I put the minute object; then I screw it and the carrot fast together. Some use potato as a substitute for the carrot but it is not so good, as the starch grains become separated and adhere to the object giving some trouble to remove them. Other objects too small even for the carrot may be secured by making a paper cone of proper diameter to fit the section holder (section cutter as it is called, but this name should be retained for the knife), then melt paraffine and pour in until you have enough, then in this set your minute objects. Allow the paraffine to harden and with, or without, the paper cone you may screw it into the holder

as you did the carrot. Then, third:—There is a section holder which is to be used only with the paraffine. It is an e egant, somewhat costly instrument, with I think on the whole a more limited range of usefulness than the second form I have described. But whether you take the second or the third form be sure that it has a glass top for the cutting surface. Brass does well for a time. but sooner or later bceomes rough and so blunts the edge of the cutter, which can never be too sharp.

Now as to the act of cutting: some objects may be cut dry, others may be required to be moistened with water or even with alcohol, and a little of the same fluid may be allowed a ong the knife edge to secure a good or uninjured specimen. The value of a section does not (beyond certain common sense limits) depend on its sixe. A small, thin seetion may, nay will, reveal more structure than a large one thick enough to be nearly opaque. Hence, make your object as large as you can to make it thin, but no larger.

Suppose it is made, and made properly, worthy of mounting permanently. How shall we do this? First, remove all dirt by washing in clean water, then remove all air by immersing in water, or glycerine or alcohol, depending upon what you mean to do with it next, and also in which we shall distend or shrink the object least. Remember here the stages I gave in my previous paper concerning tbe repeated alcohol baths it must have before it comes to be rendered clean in oil of cloves. This rids you of all water and makes it as transparent as it can be made. Now if the object has had the preliminary stages in alcohol and oil, its suitable and final mount should be balsam. I have cast aside all balsam with benzols and balsam with chloroform and come down to the slower evaporations—what is *called* balsam pure. Some objects are not injuriously distorted by this process. Indeed some delicate spores even stand it well. But this is not the rule. Spores do not generally tolerate it and retain their original symmetry and size. Hence we must find some other process.

Take for exan.ple a section of *Solorina saccata*—a lichen with charmingly large and handsome spores. I would rid it of air by first putting it in water, then after an hour or two, into glycerine, where it may remain twelve or more hours. And then I mount it in Farrants medium (bear in mind Farrants, not Tarrants medium) which Dr. Carpenter says is made by "dissolving four parts (by weight) of picked gum arabic in four parts of cold distilled water, and then adding two parts of glycerine." Make without heat, stir but don't shake it, and when it is made, strain it through washed cambric, put it into a bottle along with a small lump of camphor which will prevent fungi from developing in the sweet solution. Now, shall you make a cell or not, for your object? Not unless that object is thicker than (for a simple standard) a sheet of writing paper. If however the glass cover cannot be made to remain flat on the slide, or if an appreciable distance exists between the slide and the cover, then you need a cell. What it shall be made of depends upon its required thickness. If a deep cell is needed then you must go back to the rubber, block tin, or other cells such as I have already named. If however you want

a shallow cell, then a ring (run from the turn table) of Bell's cement, of one or two coats is all sufficient. This cement you may make yourselves by dissolving shellac in strong alcohol. It has the very great merit of drying very quickly and of resisting the action of glycerine, the last a most important quality. Put then your Solorina or other like object in the Farrants medium, with or without cell, and cover it with thin glass, put on so as to drive the air out by *pressing* down one side first and then slowly lowering the other to the horizontal, and under the gentle pressure of a wire clamp allow it to harden. Next remove the exuding surplus medium and in a few hours run from a brush a coat of Bell's cement around the edge of the cover and your slide will be done. These processes are more simple than they appear from a description. Carbolized or camphor water is also a good medium for mounting spores or sections of lichens and fungi in.

As for instruments; whilst I do not regard the turn-table or the section holder as essential, I do consider them as most important aids.

One other point. To clean glass covers I fill a small wide mouthed bottle with strong sulphuric acid, then *one by one* dip in my covers; then they are thoroughly coated with the acid, then after remaining in the acid several hours I pour it off, and by repeated washing in clean water remove most of the acidity, then I put in Labarraques solution, and after a few hours in this I pour it off and wash the bottle and glass with two or three waters and the covers are clean. To keep them so, I put in clean water, and cork the bottle. And to use the covers you have merely to dry them and they are ready for service.

In the above, hastily written, simple statements I have advanced little or nothing new, but have given the modes my own experience has approved, without regard to the sources whence they were derived. It is however fair, that I should state my attention was called to the great value of Bell's cement and Farrants medium by my friend, Prof. Barbeck, of Philadelphia, a most accomplished cryptogamic botanist.—J. T. ROTHROCK.

PTERIS AQUILINA.—I have received from Mr. F. A. White, an esteemed Florida correspondent, a specimen of *Pteris aquilina*, var. *caudata*, which measures 13 feet and 4 inches from the base of the stipe to apex of frond. The stalk measures from ¾ to 1 inch in circumference in its present dried state, and is exactly 6 feet in length, thus leaving 7 feet and 4 inches as the length of the frond. The first internode is 22 inches, the 2d, 16¼ inches, the 3d, 10¾ inches with a corresponding decrease up to the 16th internode which measures only ½ an inch, the apex measuring 2 inches, and the remaining measurements being taken up by the spaces occupied by the bases of the connecting stalks of the primary divisions.

As the primary divisions were taken off to admit of folding the stalk and rachis for mailing without breaking, I can only guess at the probable breadth of the frond; but as the frond of the common brake is nearly triangular in outline, and generally quite as broad at the base